Introduction

The production, transportation, and use of energy by our society raise important public policy issues involving the activities of both government and the private sector. Energy issues affect commerce, the provision of public services, land use planning and development, transportation, as well as most other aspects of daily life.

Using energy more wisely (energy conservation and efficiency) will save residents and businesses money and will lead to a better environment. Changes in land use patterns, transportation systems, building designs, agricultural practices, and recycling efforts can all lead to greater energy efficiency and conservation. Even changes in how electricity is produced can lead to greater energy efficiency. For example, a cogeneration facility can increase efficiency by using left over heat from an industrial process to make electricity. Conversely, a cogeneration facility could first generate power and then use the waste heat for a commercial process. The energy required to generate both the electricity and the useful heat in the cogeneration facility can be significantly less than the energy required to generate the electricity and useful heat in separate processes.

The County has abundant resources (in the form of sunlight and biomass) that can be used to generate electrical energy for local use. However, the County lacks the facilities to take advantage of such resources. In particular, a solar energy farm currently being proposed in the Carrizo Plains could minimize the County's reliance on imported electricity. A decreased reliance on imported energy resources would have positive impacts on the County. For example, the money that results from the production and distribution of energy will remain in the County and strengthen the local economy. The local economy would also benefit from the monies used to build and operate the facility. However, the environmental and social impacts of any power plant and electrical transmission line facilities must be carefully evaluated prior to approval of such facilities.

There are two remaining oil and gas fields in San Luis Obispo County. There is also an extensive network of pipes, pump stations, storage tanks, and marine terminals to transport the oil resources. In the past twenty years many of the oil facilities in the county have been closed or decommissioned.

Since the publication of the original Energy Element of the General Plan in 1995, the energy focus in the county has changed from fossil fuels production and energy generation to alternative energy, efficient building (called “green building”) and reduction in vehicle miles traveled. The reasons for this change in focus include the increasing cost of fossil fuels, the move toward reducing greenhouse gas emissions and the cost of building new infrastructure for sprawling development.

Purpose and Benefits

The purpose of the Energy Chapter is to 1) increase energy efficiency in the county, 2) provide policy basis for implementation of Strategic Growth Principles, 3) lead to creation of more compact communities and reduce rural sprawl and development, 4) determine land use and environmental criteria for evaluating future energy projects, and 5) provide for green building policies to conserve energy and water resources and to guide the County toward a sustainable energy future.

The benefits of having an Energy chapter generally come in two categories: economic and environmental. Economic advantages include:

- The Energy chapter encourages smart growth patterns. These development patterns concentrate development in a central area and provide a mix of services and jobs near housing. Because jobs and/or services are closer, this will result in fewer or shorter automobile trips and less money spent on automobile fuel and maintenance.
- Energy efficiency and conservation measures can reduce residential utility bills which increases the household disposable income and purchasing power. Likewise, such measures can reduce operating costs for businesses, which will result in lower overhead expenses and increased profits. When disposable income and business profits increase, the local economy is stronger because more dollars are generally spent in the community and re-circulate to local businesses and residents. Energy efficiency and conservation measures can reduce the need to build large scale power plants. Such facilities are expensive and may cause utility rate increases.
- The Energy Chapter encourages the development of local renewable resources, such as the solar potential in the Carrizo Plains. Solar energy development is a key to reducing greenhouse gas emissions and reducing the effects of global climate change. Such development could also create local jobs and provides local sources of electricity. The Energy Element encourages the development of smaller power producing facilities that meet local needs.

Development of energy resources often raises environmental concerns related to air and water quality, resource use, and hazardous waste disposal. The environmental benefits of such actions include:

- Residents who live in compact communities tend to drive less (or at least drive shorter distances) because services are closer. Likewise, it is easier to establish convenient bus service in compact communities. Both these actions will lead to less traffic and enhanced air quality.

- Energy efficiency and conservation measures encourage residents and businesses to use less natural gas and electricity. Most power plants in California rely on natural gas or oil as fuel. With decreased electricity use, air quality will improve because less fossil fuels are burned. The need to build large power plants can be deferred or avoided, thereby avoiding environmental impacts associated with those plants.
- Using renewable fuel resources, such as hydroelectric, solar, and cogeneration, will decrease fossil fuel consumption or improve energy efficiency. Use of alternative energy will also reduce greenhouse gas emissions and the effects of global climate change.
- Land use strategies that encourage compact communities in existing urban areas also act to preserve open space and agricultural land as described in the eleven principles of smart growth adopted by the Board of Supervisors in June 2005.

Relationship of the Energy Chapter to Other General Plan Elements

The General Plan is required by law to be an internally consistent statement of community policy. Each element of the General Plan must be integrated and consistent with all other elements. This chapter is related to goals and policies in other Elements of the County's General Plan, and other chapters within the Conservation Element.

Existing Conditions and Challenges

Most people have an intuitive understanding of the importance of energy conservation—using less energy saves money—not only in costs associated with utility bills but also in other costs that are harder to quantify, such as environmental degradation from pollution or resource depletion. The benefits of using energy wisely include improved air and water quality, less production of *greenhouse* gases (carbon dioxide and others that contribute to global warming), and increased environmental quality. The issues involving energy conservation and efficiency include: land use, transportation, new building construction, building retrofits, public facilities, agricultural practices, energy education, recycling and reuse, and related economic impacts of conservation and efficiency measures.

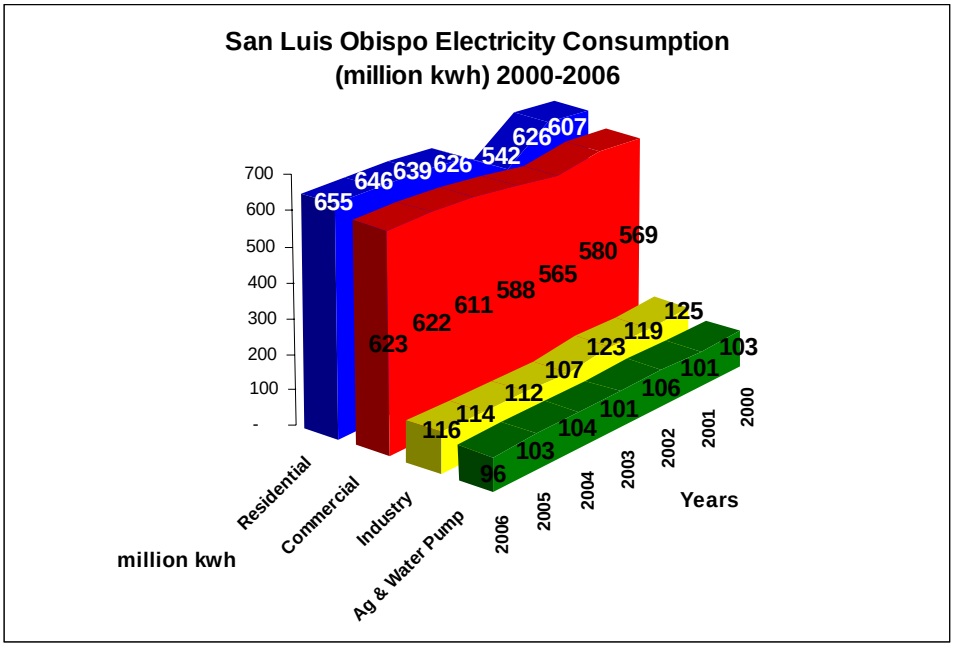
California is one of the largest users of energy in the nation. Nearly half of all energy consumed within the state is used to move people and goods. The state's residential and commercial sectors continue to rely on electricity and natural gas.

There are a number of energy resources that can be found or utilized within San Luis Obispo County, including natural gas, oil, wind, solar, biomass, and hydroelectric. In some cases available energy resources are not presently used to their potential. Some limitations include; the cost competitiveness of large scale systems, increased initial capital investment for buildings, and lack of economic incentives for developing a resource. Where the environmental

consequences can be minimized, the use of local resources may offer the best alternatives to importing large amounts of energy from other areas of the state.

Energy resources are imported into the County primarily by the two major utilities that serve the County. Pacific Gas and Electric (PG&E) provides electricity and Southern California Gas Company provides natural gas. Propane is supplied by several private companies. Gasoline is imported via tankers and trucks. Uranium and natural gas are imported into the County for conversion to electricity which is then exported to the main California power grid in the San Joaquin Valley. San Luis Obispo County receives power from that grid.

FIGURE A5-1
ELECTRICITY CONSUMPTION



Source: Pacific Gas and Electric

ENERGY CONSERVATION AND EFFICIENCY

Energy efficiency and conservation reduces the need for additional power plants or other energy facilities that could cause undesirable environmental effects as mentioned in the introduction. Business profits will be greater if business energy costs are reduced (all other factors held constant), and residential energy customers will have more disposable income to spend for non-energy purposes if their energy costs are reduced. Many energy saving measures are inexpensive and have a short payback period. Some require a larger capital investment than others. The local and regional economy can also benefit from the money spent on home or business improvement projects to increase energy efficiency.

This chapter identifies opportunities for County residents and businesses to use energy more wisely through conservation and efficiency programs. These ideas include:

- developing compact land use patterns,
- decreasing reliance on cars and encouraging more walking, biking, and riding the bus,
- constructing more energy efficient homes and buildings,
- ensuring that County facilities and operations are as energy efficient as possible,
- continuing to take advantage of energy saving opportunities in agricultural operations, and
- promoting recycling and reuse programs.

Regulatory Framework

Regulations at the local, regional, state and national level provide policy and regulation for energy resources and supply. Several applicable policies and legislation related to energy are outlined below.

NATIONAL

National Energy Policy

The components of National Energy Policy include:

- The Policy is a long-term, comprehensive strategy.
- The Policy will advance new, environmentally friendly technologies to increase energy supplies and encourage cleaner, more efficient energy use.
- The Policy seeks to raise the living standards of the American people, recognizing that to do so our country must fully integrate its energy, environmental, and economic policies.
- The National Energy Policy seeks to increase America's use of renewable and alternative energy. The Policy provides numerous recommendations to support the production and use of alternative and renewable energy including, but not limited to:
- To reevaluate access limitations to federal lands in order to increase renewable energy production, such as biomass, wind, geothermal and solar,
- Budget amendment to provide increased support for research and development of renewable energy resources.
- Conduct a review of current funding and historic performance of renewable energy and alternative energy research and development programs, and

- Expand tax credits to include landfill methane projects.

STATE

Global Warming Solutions Act of 2006 (AB 32)

Signed in September 2006, AB 32 requires that statewide greenhouse gas (GHG) emissions be reduced to 1990 levels (427 million metric tons of carbon dioxide equivalent) by the year 2020, an expected 29 percent reduction. This reduction will be accomplished through an enforceable statewide cap on GHG emissions.[1] To effectively implement the cap, AB 32 directs the California Air Resources Board to develop and implement regulations to reduce statewide GHG emissions from stationary sources.

California Building Standards Code, Title 24

Adopting green building standards requires an amendment to the California Building Standard Code (BSC). According to California State law, any city, County, or fire protection district may establish more restrictive building standards than those contained in the California Building Standards Code (California Code of Regulations, Title 24), if the amendment is reasonably necessary because of local climatic, geological, or topographical conditions [Health and Safety Code Section 18941.5(b)].

When making a local amendment, the law requires that a city or County do all of the following [Health and Safety Code Section 17958.7(a)]:

1) Expressly mark and identify each change to existing building standards.
2) Make an express finding that each change is reasonably necessary because of local climatic, geological, or topographical conditions.
3) File with the BSC a copy of each change and its related findings.

No city or County amendment is effective until the city or County files the change and its related findings with the BSC. The failure of a city or County to file its amendment with the BSC implies that the California Building Standards Code, without amendment, applies within that local jurisdiction.

California Code of Regulations, Title 20

Title 20, last amended in March 2007, includes regulations pertaining to the rules of practice and procedure and power plant site certification. The California Energy Commission has the statutory authority to site and license thermal power plants that are rated at 50 megawatts and larger.

[1] California Air Resources Board, Staff Report California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit, November 16, 2007.

SB 1078, SB 107, and Assembly Bill 1585

Originally, SB 1078 established a Renewable Portfolio Standard (RPS) program in 2002, with the goal of increasing to 20 percent by 2017 the percentage of the state's electricity that is sold to retail customers and derived from renewable resources.

Spurred by the 2003 Energy Action Plan adopted by the Energy Commission and the California Public Utilities Commission (CPUC), SB 107 accelerated and codified the target year to be 2010. Under SB 107, publicly owned utilities are required to report to the Energy Commission the resource mix they use to serve their customers using the categories defined as eligible for the RPS for the state's investor-owned utilities, electric providers, and community choice aggregators.

The 2004 Integrated Energy Policy Report (IEPR) Update recommended expanding the target to 33 percent by 2020, which was reinforced by the 2005 IEPR and 2006 IEPR Update.

Assembly Bill 1585 requires the Energy Commission to evaluate the feasibility of the 33 percent by 2020 renewable goal.

Assembly Bill 1969

Assembly Bill 1969 requires Investor Owned Utilities to set a tariff to purchase renewable generation from small facilities operated by public water and wastewater agencies. The purpose of AB 1969 is to bring in additional RPS-eligible energy from facilities that are too small to participate in utility RPS solicitations, either because they fail to meet minimum size requirements or because the process is too complex.

Assembly Bill 809

Affects the Renewable Portfolio Standard (RPS) eligibility of hydroelectric facilities by changing the definition of an "eligible renewable energy resource" to include conduit hydro of 30 megawatt or less under certain conditions and allows small hydro facilities with efficiency improvements that increase their capacity above 30 megawatts to retain their RPS eligibility, also under specific conditions.

Solar Water and Heating Efficiency Act of 2007

The Solar Water and Heating Efficiency Act of 2007 was passed to create a broad market for solar heating technologies by offering $250 million in rebates for the state's consumers over the next ten years that will be implemented by the Public Utilities Commission.

California's Bioenergy Action Plan

On August 23, 2005, the California Biomass Collaborative was reinvigorated by the Governor and in 2006 produced California's Bioenergy Action Plan. The Action Plan is an integrated and comprehensive state policy on biomass, which includes electricity, natural gas and petroleum

substitution potential. The Action Plan outlines the substantial potential benefits of bioenergy. The actions contained in the Plan create the necessary institutional and regulatory changes that will substantially increase the production and use of biomass for energy in California.

California Solar Initiative

California has set a goal to create 3,000 megawatts of new, solar-produced electricity by 2017 as part of Governor Arnold Schwarzenegger's $3.3 Billion Million Solar Roofs Program, The California Public Utilities Commission (CPUC), through its California Solar Initiative, provides incentives for existing residential homes and existing and new commercial, industrial, and agricultural properties over the next decade. Additionally, the California Energy Commission is managing a 10-year, $400 million program to encourage solar electricity in new home construction through its New Solar Homes Partnership.

In August 2006, the Governor signed Senate Bill 1 (SB1), which directs the CPUC and the California Energy Commission to implement the California Solar Initiative program consistent with specific requirements and budget limits set forth in the legislation.

Climate Change[2]

Current atmospheric concentrations of carbon dioxide (CO_2), primarily from the burning of fossil fuels and land use change, are substantially higher than the natural range measured over the last 650,000 years (Intergovernmental Panel on Climate Change, Fourth Assessment Report, 2007). This has led to an unprecedented rate of global climate change that could have profound implications for San Luis Obispo County. It could also complicate regional attempts to achieve ozone ambient air quality standards, since warmer temperatures lead to increased formation of ozone. Climate change needs to be addressed holistically with policies that reduce greenhouse gas emissions stemming largely from burning fossil fuels for energy and transportation, while also preparing the County to adapt to a changing climate.

The goals and policies outlined in this chapter seek to reduce the County's reliance and use of fossil fuel based energy sources, which in turn reduce greenhouse gas and criteria air pollutants. The Air Quality Chapter contains specific goals, policies and implementation strategies aimed at mitigating and adapting to climate change.

Green Building

The Conservation Element of the San Luis Obispo County General Plan recognizes that sustainability must be an organizing principle for all County actions and programs, and that we

[2] The reader is encouraged to consult Appendix 1 Air Quality of this element for a detailed overview of climate change.

must always consider the interdependent goals of protecting the environment, promoting social equity, and achieving a healthy economy. A sustainable community is one that meets its existing needs without compromising the ability of future generations to meet their own needs.

Through this Green Building chapter of the Conservation Element, San Luis Obispo County is taking a proactive role in achieving sustainable development and mitigating climate change through promoting and encouraging wise resource use, energy efficiency, and healthy indoor environments for our future generations to enjoy.

Several of the County's Guiding Principles for Smart Growth are relevant to green building including:

Foster Distinctive, Attractive Communities with a Strong Sense of Place: The County will employ context-sensitive design techniques and encourage communities to incorporate smart growth design

Create a Range of Housing Opportunities and Choices: Communities should maximize "choices" in location, size, design, diversity, cost, and type of housing. The central goal of any smart growth plan is the quality of the neighborhoods where we live. They should be safe, convenient, attractive, and affordable

Take Advantage of Compact Building Design: The County will encourage communities to incorporate more compact building design as an alternative to conventional, land consumptive development.

Make Development Decisions Predictable, Fair and Cost Effective: For communities to be successful in implementing smart growth, both the private and public sector must embrace it. The County will seek ways to reduce complexities often encountered in the development review process and improve processing times and predictability.

Encourage Community and Stakeholder Collaboration: The County will support community and broad stakeholder collaboration.

The population of San Luis Obispo County has a growing interest in reducing the energy output of structures, conserving water, reducing emissions, and creating healthy places while supporting development and economic growth. While conventional design and construction methods focus on the design and construction of buildings that are structurally sound, they often ignore the potential impacts to the environment as well as the health and productivity of the occupants of buildings. Inefficient buildings can be expensive to operate and contribute to excessive resource consumption, waste generation, and pollution. By contrast, green building design, construction and operation techniques seek to address these negative impacts by

employing methods and building materials that promote natural resource conservation, energy efficiency, and good indoor air quality.

GREEN BUILDING DEFINITION AND BRIEF BACKGROUND

Green building is an integrated framework of design, construction, operations, and demolition practices that encompasses the environmental, economic, and social impacts of buildings. Green building practices recognize the interdependence of the natural and built environments and seek to minimize the use of energy, water, and other natural resources and provide a healthy, productive indoor environment. Green building is a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community. It includes the following practices and principles:

a. Designing for livable communities;
b. Using sun and site to the building's advantage for natural cooling, heating and daylight
c. Incorporating durable, salvaged, recycled, and sustainably harvested materials;
d. Insulating well and ventilating appropriately;
e. Reducing and recycling construction and demolition waste;
f. Using healthy products and building practices; and
g. Landscaping with native, drought resistant plants and water-efficient practices.

These green building principles and practices provide the following benefits:

Environmental benefits:

a. Improve air and water quality
b. Reduce solid waste
c. Conserve natural resources
d. Enhance and protect ecosystems and biodiversity

Health and community benefits:

a. Protect health of workers and residents
b. Enhance quality of life in our communities
c. Minimize strain on local infrastructure

Economic benefits:

a. Improve construction quality

b. Increase building longevity
c. Reduce utility, maintenance and infrastructure costs
d. Long-term economic efficiency

Green building design, construction, and operational techniques have become increasingly widespread. Many homeowners, businesses, and building professionals have voluntarily sought to incorporate green building techniques into their projects. A number of local and national systems have developed to serve as resources and guides to green building practices.

At the national level, the United States Green Building Council (USGBC, http://www.usgbc.org), developer of the Leadership in Energy and Environmental Design (LEED™) Green Building Rating System and Reference Guide, has become a leader in promoting and guiding green building. LEED is a third party certification program and the nationally accepted benchmark for the design, construction, and operation of high performance green buildings. LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their buildings' performance. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. The LEED Professional Accreditation program is managed by the Green Building Certification Institute (GBCI). Currently, LEED certification programs exist for New Construction and Major Renovations, Existing Buildings: Operations & Maintenance, Commercial Interiors, Core & Shell, Schools (K-12), Retail, Healthcare, Homes, and Neighborhood Developments.

Locally, the California Central Coast Chapter or C^4 (http://www.usgbcc4.org/) of the USGBC supports its mission by serving as a regional conduit for sustainable design, facilitating collaboration and a unified voice for the tri-county Central California Coast region (Ventura, Santa Barbara, and San Luis Obispo) to preserve and improve a unique quality of life and to promote a healthy and prosperous environment. The core purpose of California Central Coast Chapter (C4) is:

- To create a regional network of green building professionals who are committed to sustainable design;
- To support and promote local green building organizations;
- To be a sustainable resource for local governments;
- To educate local building industry professionals and trades groups;
- To provide local college communities a direct connection to green building professionals;
- To engage the public and create awareness through education;

- To join with the national green building movement in all of its efforts.

Build It Green (http://www.builditgreen.org/) is California-based non-profit membership organization whose mission is to promote healthy, energy- and resource-efficient building practices in California. The organization's efforts are focused on increasing the supply of green homes in the state, raising consumer awareness about the benefits of building green, and providing a valuable resource to building industry professionals and homeowners. Formed in 2003, Build It Green™ is a joint effort of local and regionally focused public agencies, building industry professionals, manufacturers, and suppliers. GreenPoint Rated™ is a program of Build It Green and includes New Home Green Building Guidelines, Home Remodeling and Multifamily Green Building Guidelines. The Guidelines were developed through a partnership among local and state agencies, local developers, architects, contractors, and green building experts. A GreenPoint Rated™ home is graded on five categories: energy efficiency, resource conservation, indoor air quality, Water Conservation, and Community. The guidelines may supplement the LEED™ for Homes and Neighborhood Development rating systems.

SLO Green Build™ (http://www.slogreenbuild.org/) is a local non-profit organization that is working on green building issues in San Luis Obispo County. SLO Green Build is a non-profit group of architects, builders, community planners, and area residents who are committed to promoting green building practices in the Central Coast. The organization assists local governments, building professionals, and homeowners use sustainable building practices and materials in the design, construction, and remodel of buildings in the County. The organization also supports and helps to develop public policy which advocates for sustainable architecture and healthy communities. SLO Green Build's three primary goals are healthy communities, resource conservation, and energy efficiency. The organization promotes workshops and events, produces a quarterly publication, an online resource library, and provides resources and guidelines for green building programs. SLO Green Build created a SLO County Supplement to Build It Green's New Home Construction Green Building Guidelines to educate uses on general climatic conditions and passive building techniques suited for the county. SLO Green Build is supported by members who include private and public entities.

Major Issues

The current and projected construction and building challenges for San Luis Obispo County can be categorized into the following key issues. While the County cannot singularly solve all of them, outlining the problems that need to be solved allow the General Plan to sharpen its green building goals and policies to help improve global, regional, and local air quality for this and future generations.

NATIONAL

Buildings are the largest energy consuming and greenhouse gas emitting sector in the U.S. Buildings represent 39% of U.S. primary energy use (includes fuel input for production).[3] Buildings represent 70% of U.S electricity consumption. [4] Buildings are one of the heaviest consumers of natural resources and account for a significant portion of the greenhouse gas emissions that affect climate change. In the U.S., buildings account for 39% of all CO2 emissions.[5]

Over the next 30 years, 80% of the building stock in the U.S. will be either new or remodeled: 52 billion square feet will be torn down, 150 billion square feet of space will be renovated, and 150 billion square feet will be brand new. There is an opportunity to significantly reduce energy use and greenhouse gas emissions, while achieving cost savings in the buildings sector by 2040.[6]

STATE

The residential sector accounts for approximately 31% of the electricity consumed in California.[7] New development will need to accommodate the increase of building construction and the growth of the state's population, while ensuring that minimal impact on the natural environment. The state's population is expected to be 48,240,891 in 2030 (30% increase from 2007) and 59,507,876 in 2050 (60% increase from 2007).[8]

Renovations are expected to the existing building stock within the next 30 years. Approximately 80% of the existing building stock 275 billion square feet will be transformed. Renovations expected in the US include residences, places of business and industrial facilities and account for approximately 150 billion square feet (54 percent of the existing building stock.[9]

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[3] 2003 U.S. DOE Buildings Energy Data Book.

[4] 2003 U.S. DOE Buildings Energy Data Book.

[5] Source: EIA Annual Energy Review 2005. U.S. Energy Information Administration, U.S. Department of Energy.

[6] Mayors for Climate Protection, http://www.coolmayors.com/common/news/reports/detail.cfm?Classification=report&QID=3487&ClientID=11061&TopicID=0&ThisPage=3&subsection=buildings

[7] source to be confirmed

[8] Department of Finance, Population Projections by Race/Ethnicity, Gender and Age for California and it Counties 2000-2050, available online at: http://www.dof.ca.gov/html/DEMOGRAP/ReportsPapers/Projections/P3/documents/CALIFORNIA.XLS

[9] Integrated Waste Management Board, Sustainable (Green) Building: Residential Green Building. Available online at: http://209.85.175.104/search?q=cache:ZBY2GbO5SNwJ:www.ciwmb.ca.gov/GreenBuilding/Residential/+electricity+use+by+buildings+in+California+31%25&hl=en&ct=clnk&cd=3&gl=us

LOCAL

New development in the County will need to accommodate the County's projected population increase. San Luis Obispo County's population is expected to increase 21 percent by 2030 (from 262,594 to 316,613 in 2030).[10]

Existing conventional buildings in the county do not efficiently use natural resources such as water and energy. Green buildings can significantly reduce water and energy use. One-fifth of present energy consumption and up to 45 million tonnes of CO_2 per year could be saved by 2010 by applying more ambitious standards to new and existing buildings.[11] Inefficient water and energy use in buildings results in high cost utility bills. In typical commercial buildings in California, energy costs are a significant component of operating costs, representing between 10-15%.[12]

The production and transportation of construction materials typically involves the burning of fossil fuels and results in the emission of greenhouse gases. Current atmospheric concentrations of carbon dioxide (CO_2), the primary greenhouse gas, have led to an unprecedented rate of global climate change that could have profound implications for San Luis Obispo County.

Most construction debris is transported directly to local landfills. The construction of a 2,000 square foot home generates approximately 3 tons of waste.[13] Construction waste, alternatively, can often be reused and recycled, thereby reducing the amount of waste transported to landfills.

EXISTING CONDITIONS AND CHALLENGES

Building Sector Statistics

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[10] State of California, Department of Finance, E-5 Population and Housing Estimates for Cities, Counties and the State, 2001-2001 with 2000 Benchmark. Sacramento, California, May 2007; and, State of California, Department of Finance, Population Projections for California and Its Counties 2000-2050, Sacramento, California, July 2007.

[11] United Nations Environment Programme, Press Release: Buildings Can Play a Key Role in Combating Climate Change, March 29, 2007. Available online at: http://www.unep.fr/pc/sbc/documents/unep_press_release_070329.pd

[12] Institute for Market Transformation, Recognition of Energy Costs and Energy Performance in Commercial Property Valuation, February 1999, Available online at: HYPERLINK "http://www.imt.org/PDF%20files/CA%20RGs%202-99.PDF" http://www.imt.org/PDF%20files/CA%20RGs%202-99.PDF . Accessed on March 27, 2008.

[13] Letter to the Green Building Committee from David Walls, Executive Director, Green Building Standards, May 15, 2007, Available online at: http://www.documents.dgs.ca.gov/bsc/documents/Green%20Build.%20Web%20Info.pdf

The built environment impacts our natural environment, economy, health, and productivity. Buildings are one of the largest consumers of natural resources and account for a significant portion of the greenhouse gas emissions that affect climate change. In the United States, buildings account for:

- 65% of electricity consumption
- 36% of energy use
- 30% of greenhouse gas emissions
- 30% of raw material use
- 30% of waste output
- 12% of potable water consumption.[14]

The current total U.S. building stock equals approximately 300 billion square feet. Every year in the U.S., approximately 1.75 billion square feet of buildings is torn down, 5 billion square feet are renovated, and 5 billion square feet are created.[15]

The building sector is expected to continue to grow; new and renovated construction is predicted to accommodate increasing population growth. By the year 2035, approximately three quarters (75 percent) of the total built environment will be either new or renovated.[16]

The California Department of Housing and Community Development predicts that if California's population continues to grow at its current rate, an average of 220,000 additional housing units will need to be constructed every year by 2020.[17]

Stakeholder Education and Buy-in

The green building industry is growing and expanding significantly with each passing year. By 2009, 80% of corporate America is expected to be engaged in green practices at least 16% of the time and 20% will be engaged 60% of the time.[18] By 2010, the McGraw Hill Green Building Smart Market Report (2006) estimates that approximately 10% of commercial construction

[14] U.S. Green Building Council, http://www.usgbc.org/, accessed February 15, 2008

[15] Architecture 2030, The Building Sector: A Historic Opportunity, 2006-2008, Available online at: http://www.architecture2030.org/current_situation/hist_opportunity.html. Accessed on: March 28, 2008

[16] Architecture 2030, The Building Sector: A Historic Opportunity, 2006-2008, Available online at: http://www.architecture2030.org/current_situation/hist_opportunity.html. Accessed on: March 28, 2008

[17] California Department of Housing and Community Development, Raising the Roof – California Housing Development Projections and Constraints 1997-2020, May 200. http://www.hcd.ca.gov/hpd/hrc/rtr

[18] McGraw Hill Construction, Greening of Corporate America SmartMarket Report, 2006

starts are expected to be green. Nearly 3.2 billion square feet of commercial space are involved with the LEED™ Green Building Rating System.

The USGBC, as well as numerous other organizations, are gaining momentum and support for green building. The USGBC has 13,500 member organizations including corporations, governmental agencies, nonprofits, and others throughout the industry. Since 2000, USGBC's membership has increased ten-fold.[19] The USGBC offers numerous workshops and courses to achieve LEED™ accreditation, learn about LEED™ technical reviews, and green building application and implementation. Similarly, Build It Green provides resources, hosts events, and offers numerous certified green building professional training and workshops. Build it Green short-term goal is to facilitate the greening of 10,000 housing units by the end of 2008.

Architecture 2030, a non-profit, non-partisan, and independent organization, was established in 2002 and has created the 2030 Challenge.[20] Signatories to the 2030 Challenge agree to design and build buildings whose energy consumption is 50% of the regional average and to adopt a regimented fossil fuel standard to be carbon-neutral by 2030. To date, numerous organizations, jurisdictions, and firms have adopted the challenge, including the California Energy Commission, US House of Representatives Energy Bill, American Institute of Architects (AIA), U.S. Green Building Council (USGBC), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Architecture 2030, US Conference of Mayors, and more.

In addition, the U.S. Mayors Climate Protection Agreement includes over 750 mayors who have committed to reducing their GHG emissions 7% below 1990 levels by 2012. The partnership promotes green building practices and principles as a tool to reduce GHG emissions.

Regulatory Framework

STATE REQUIREMENTS

The goals, policies, and implementation programs in this chapter are consistent with and in support of the following state regulations and policies.

California Building Standards Code

California Code of Regulations (CCR), Title 24, is also known as the California Building Standards Code. Proposed state agency combined green building standards are scheduled for public review and rulemaking as the 2007 California Green Building Standards Code, CCR, Title 24, Part 11. The purpose of this code is to improve public health, safety and general welfare by

[19] U.S. Green Building Council, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1718, accessed February 15, 2008.

[20] Architecture 2030, The Building Sector: A Historic Opportunity, 2006-2008, Available online at: http://www.architecture2030.org/current_situation/hist_opportunity.html. Accessed on: March 28, 2008

enhancing the design and construction of buildings through the use of building concepts having a positive environmental impact and encouraging sustainable construction practices in the following categories: 1) planning and design; 2) energy efficiency; 3) water efficiency and conservation; 4) material conservation and resource efficiency; and 5) environmental air quality.

Adopting local green building standards requires an amendment to the California Building Standards Code (BSC). According to California State law, any city, county, or fire protection district may establish more restrictive building standards than those contained in the California Building Standards Code (California Code of Regulations, Title 24), if the amendment is reasonably necessary because of local climatic, geological, or topographical conditions [Health and Safety Code Section 18941.5(b)]. No city or county amendment is effective until the city or county files the change and its related findings with the BSC. The failure of a city or county to file its amendment with the BSC implies that the California Building Standards Code, without amendment, applies within that local jurisdiction.

California Energy Commission

Title 24, Part 6 provides the state's Energy Efficiency Standards for Residential and Non-Residential Buildings. Public Resources Code Section 25402.1(h) 2 and Section 10-106 of the Building Energy Efficiency Standards (Standards) establish a process which allows local adoption of energy standards that are more stringent than the statewide Standards. This process allows local governments to adopt and enforce energy standards before the statewide Standards effective date, require additional energy conservation measures, and/or set more stringent energy budgets. Local governments are required to apply to the California Energy Commission (CEC) for approval, documenting the supporting analysis for how the local government has determined that their proposed Standards will save more energy than the current statewide Standards and the basis of the local government's determination that the local standards are cost-effective. Once the Energy Commission staff has verified that the local standards will require buildings to use no more energy than the current statewide Standards and that the documentation requirements in Section 10-106 are met, the application is brought before the full Energy Commission for approval.

Executive Order S-20-04

Executive Order S-20-04, signed in December 2004, establishes the State's priority for energy and resource-efficient high performance buildings. The Order sets a goal of reducing energy use in state-owned buildings by 20% by 2015 (from a 2003 baseline) and encourages the private commercial sector to set the same goal. The Order also directs the compliance with the Green Building Action Plan, which details about the measures the state will take to meet these goals.

Among several tasks, the Order directs the California Energy Commission (CEC) to develop commissioning and retro-commissioning guidelines for commercial buildings.

California Solar Initiative (Million Solar Roofs Program)

As part of the Governor's Million Solar Roofs program, California has set a goal to create 3,000 megawatts of new, solar-produced electricity by 2017 - moving the state toward a cleaner energy future and helping lower the cost of solar systems for consumers. At the direction of Governor Schwarzenegger, the California Public Utilities Commission (CPUC) approved the California Solar Initiative (CSI) on January 12, 2006, a $3.3 billion ten-year incentive program that aims to add solar panels to a million roofs across the state. The overall goal is to help build a self-sustaining photovoltaic, solar electricity market. On August 21, 2006, the Governor signed Senate Bill 1 (SB1), which directs the CPUC and the Energy Commission to implement the CSI program consistent with specific requirements and budget limits set forth in the legislation. As of January 1, 2007, the $3.3 billion program consists of three components:

The California Public Utilities Commission, through its California Solar Initiative, provides incentives over the next decade for existing residential homes and existing and new commercial, industrial, and agricultural properties. The program is funded through revenues and collected from electric utility distribution rates. All electric customers of Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E) are eligible to apply for incentives. Ten percent of program funds are allocated for solar installations in low-income and affordable housing.

The California Energy Commission manages a 10-year, $400 million program to encourage solar in new home construction through its New Solar Homes Partnership.

Beginning January 2008, the Publicly Owned Utilities (POU) component of Senate Bill 1 requires each municipal utility to offer a solar incentive program to its customers. The POUs will be spending $784 million over 10 years, toward a goal of 660 MW.

Integrated Waste Management Act (AB 939)

In 1989, Assembly Bill 939, known as the Integrated Waste Management Act, was passed and the current California Integrated Waste Management Board (CIWMB, http://www.ciwmb.ca.gov/) was established. A disposal reporting system with CIWMB oversight was established, and facility and program planning was required. AB 939 mandates a reduction of waste being disposed: jurisdictions were required to meet diversion goals of 25% by 1995 and 50% by the year 2000. AB 939 also established an integrated framework for program implementation, solid waste planning, and solid waste facility and landfill compliance. AB 939 requires counties to prepare a Countywide Integrated Waste Management Plan (CIWMP).

The San Luis Obispo County Integrated Waste Management Authority (IWMA) formed in 1994 to plan and implement regional solid waste and hazardous waste programs. Members include San Luis Obispo County and the Cities of Arroyo Grande, Atascadero, Grover Beach, Morro Bay, Paso Robles, Pismo Beach, San Luis Obispo and the Community Service Districts.

LOCAL REQUIREMENTS

County of San Luis Obispo Construction and Demolition Debris Recycling Ordinance

The Construction and Demolition Debris Recycling Ordinance (Section 8.12.455 of the County Code) applies to construction or renovation projects within the unincorporated County, including County sponsored projects, with a valuation of $50,000 or higher. In addition, all demolition projects equal to or greater than 1,000 square feet must also comply. The goal is to divert, by recycling or reuse 50% or more of all project-related construction and demolition debris.

CONSERVATION AND EFFICIENCY (Excerpted from the 1994 Energy Element)

This section identifies opportunities for county residents and businesses to use energy more wisely through conservation and efficiency programs. These ideas include:

- instituting smart growth principles,
- decreasing reliance on cars and encouraging more walking, biking, and riding the bus,
- constructing more energy efficient homes and buildings using green building technologies,
- ensuring that county facilities and operations are as energy efficient as possible,
- continuing to take advantage of energy saving opportunities in agricultural operations, and
- promoting recycling and reuse programs.

Most people have an intuitive understanding of the importance of energy conservation and energy—using less energy saves money—not only in costs associated with utility bills but also in other costs that are harder to quantify, such as environmental degradation from pollution or resource depletion. The benefits of using energy wisely include improved air and water quality, less production of greenhouse gases (carbon dioxide and others that may contribute to global warming), and increased environmental quality. The issues involving energy conservation and efficiency include: land use, transportation, new building construction, building retrofits, public facilities, agricultural practices, energy education, recycling and reuse, and related economic impacts of conservation and efficiency measures.

Benefits of Energy Conservation and Efficiency

Energy efficiency and conservation reduces the need for additional power plants or other energy facilities that could cause undesirable environmental effects as mentioned in the introduction. Business profits will be greater if business energy costs are reduced (all other factors held constant), and residential energy customers will have more disposable income to spend for non-energy purposes if their energy costs are reduced. Many energy saving measures are

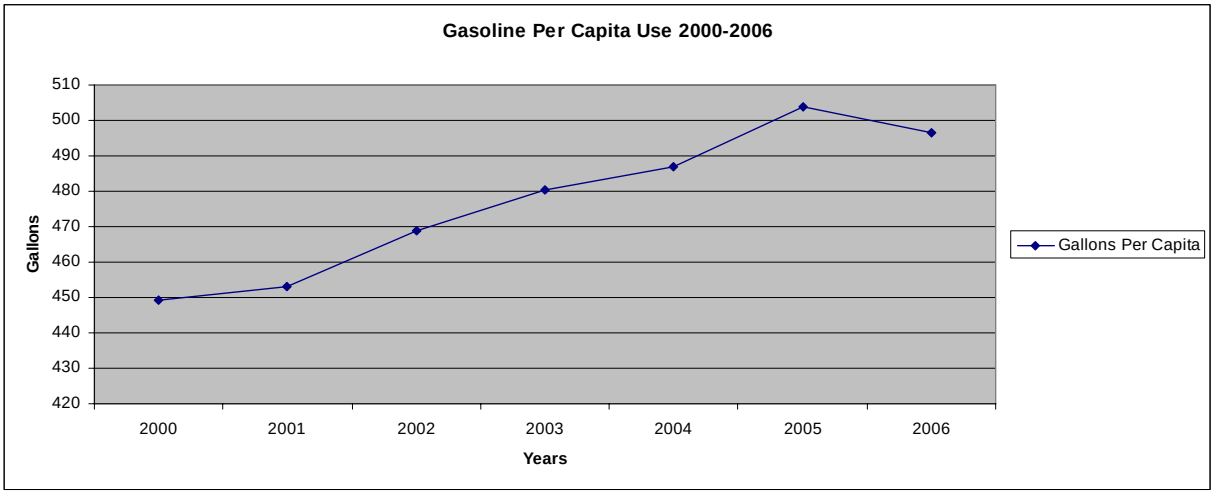
inexpensive and have a short payback period. Some require a larger capital investment than others.

Land Use

Land use strategies for saving energy include: compact urban form, multi-modal transportation-oriented development, increased solar access, providing for mixed land uses, and energy conservation through landscaping.

As residents move into the unincorporated areas of the county, the location of new homes in relation to jobs and services will have a significant impact on energy use. The location of different land uses in relation to one another can obviously affect travel distances and the mode of transportation people are most likely to use (walking, bicycle, car, transit, etc.). Different land uses also generate varying amounts of traffic; a day care center will generate more trips than a single-family home. The graph below shows that from 1999 to 2006, per capita gasoline use in the county grew from 449 gallons to 496 gallons per person.

FIGURE A5-2
GASOLINE PER CAPITA USE



Source: Office of Transportation Economics, Division of Transportation Planning, Caltrans

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The development model described above follows the eleven "Smart Growth Principles" adopted by the Board of Supervisors and referred to as Strategic Growth:

Strategic Growth Principles

1) Preserve open space, scenic natural beauty and sensitive environmental areas.
2) Strengthen and direct development towards existing communities.

3) Foster distinctive, attractive communities with a strong sense of place.
4) Create walkable neighborhoods and towns.
5) Provide a variety of transportation choices.
6) Create a range of housing opportunities and choices.
7) Encourage mixed land uses.
8) Take advantage of compact building design.
9) Make development decisions predictable, fair and cost-effective.
10) Encourage community and stakeholder collaboration.
11) Strengthen regional cooperation.

Compact Urban Form

Building compact housing (more homes on less land) and diverse housing (a mixture of single-family homes, duplexes, townhouses) can increase the energy efficiency of a community as well as help address issues related to housing, air quality, open space, farmland preservation, traffic congestion, etc.

A compact urban form provides urban services to concentrated areas of residences and commercial or industrial business. In general, compact development can be achieved by encouraging infill development more economically. Likewise, subdivisions that are adjacent to the existing community boundaries should be encouraged over those that are far from community centers.

Drive Less, Walk and Ride More. Compact urban form can increase opportunities for residents to complete shopping and other chores without driving or by driving shorter distances. People are most likely to walk rather than drive if their destination is within one-quarter mile (Calthorpe, 1992). If more people were to walk or ride bikes for short trips, gasoline use would decrease, air quality would improve, and less energy would be used to build and maintain parking lots. Concentrating the density of residential and commercial development can also facilitate the provision of transit services to an area by increasing convenience for households.

Locate Jobs and Housing. The home-to-work trip accounts for about one-third of all private vehicle trips in a typical urban area. In rural areas the ratio is even higher. The length and location of these trips is an important factor in determining the type of transportation alternatives available to the commuter and the quantity of air pollutants generated. There are two principal approaches to reduce the number of commute vehicle trips.

1) One solution is to locate jobs and housing in proximity to one another. There are some inherent problems in this approach. One flaw is that most family households have two

workers, and both workers may not find employment in the same community. Also, some people may choose a housing location distant from their job because factors other than proximity attract them. Locally, some people who work in San Luis Obispo choose to live in Atascadero because they prefer the climate and countryside of the north county. Housing costs in the county vary widely from community to community. Another challenge is to ensure that the jobs/wages and housing affordability are matched.

2) The second method of reducing commuter vehicle trips is to concentrate jobs in a few locations in the county. This makes it more cost effective to provide mass transit and carpooling to those areas. With faster, cheaper mass transit options, more people are likely to use the service.

The county continues to develop a mass transit system to meet the needs of a population that is located over a large geographic region. Because less expensive housing continues to be located in the northern and southern portions of the county while many of the jobs are located in the central portion of the county, many people commute relatively long distances to work. This leads to increased vehicle trips, gasoline consumption and air pollution. One goal of the Energy Chapter is to encourage residents to use transit systems and other energy efficient transportation options (see following discussion on transportation). By promoting a better balance between available jobs and housing, the total vehicle miles traveled can decrease.

Reduce Utility Service Lengths. Finally, compact urban form can decrease energy use by reducing the length and width of roads and/or utility service connections in new development. By reducing the size of lots in developed areas, the physical length of roads and utility service lines and the amount of energy used to construct the roads or lines (pipelines, electrical lines, etc.) are reduced. The gasoline used by Sheriff, police, fire, and other county services in such areas is also reduced.

Narrowing street widths reduces the amount of pavement used to construct the roadway, and it has the added benefit of reducing the energy used during the summer to cool buildings. Pavement surfaces act as solar heat collectors in the summer. This increases the air temperature near those surfaces and creates greater demand in nearby buildings for air conditioners, fans, coolers, etc.

Although the short-term energy savings may not be significant, land use planning techniques can produce major savings in long-term energy use as development and redevelopment continue. The real monetary savings will come in 10 or 20 years when county communities do not have to build a new sewer plant, enlarge a water distribution system to supply a remote rural subdivision, or add lanes to county roads and subsidize a bus system because of traffic congestion.

Compact development can also reduce pressures for the conversion of agricultural lands. Given the valuable agricultural lands found in San Luis Obispo County, the benefits of saving agricultural land in viable production are enormous.

The first Strategic Growth principle is to preserve open space, scenic natural beauty and sensitive environmental areas. These resources exist chiefly in the unincorporated rural areas of the county. Strategic Growth attempts to redirect development from these rural areas that support natural resources, agriculture and scenic areas and into urban areas. A more compact for of urban development will allow these resource areas to remain whole and mostly undisturbed. At the same time, a more compact form of development will reduce overall vehicle miles traveled (VMT) in the county and will conserve energy.

Alternative Transportation-Oriented Development

Development patterns that facilitate pedestrian, bicycle, and efficient transit can be effective in reducing energy use. One component is to provide for mixed land uses.

- 10% of residents use transit to commute if they live less than a 1/4 mile from a stop
- 4% of residents use transit to commute if they live 1/4 to 2 miles from a stop
- Less than 1% of residents use transit to commute if they live 2+ miles from a stop.

Provide for Mixed Land Use. In the days before widespread auto use, city dwellers often lived closer to where they worked, used public transportation, and bought groceries and conducted household business within their neighborhoods. With the advent of the street car system (and later the automobile), housing began to spread further from areas of employment and commercial services. As a means of reducing miles traveled, communities should allow a mixture of land uses that enable people to walk or bicycle to work or to purchase necessary household items at locations convenient to their neighborhood.

Mixed land use is also a strategy for achieving compactness in urban development. While conventional zoning typically results in the spatial separation of different land uses, mixed use recognizes that some land uses are functionally compatible with one another and need not be physically separated. A common form of mixed-use development is a ground level commercial use with residential uses above.

Compact urban form facilitates alternative transportation opportunities, but there are additional land use strategies that can be employed to further increase walking, biking, and transit use.

As mentioned above, people are most likely to walk rather than drive if their destination is within one-quarter mile. This means that land uses should be carefully planned to complement adjoining uses. For instance, schools, day care services, dry cleaners, and convenience stores can all be located near transit stops or near large residential concentrations.

Another example for designing communities is the Radburn concept which incorporates ideas of compact, limited sized towns with internal walkable greenbelts. The Radburn concept calls for integrated parks that are connected with a system of paths. A major purpose of this design is to decrease pedestrian conflicts with the automobile.

People are also more likely to walk or ride bicycles where bike paths or sidewalks are separated from streets. When physically possible and financially feasible, separate bike or pedestrian paths should be established away from busy streets and intersections.

Incorporating such features into a linear park are often very effective. The City of Davis, California is an example of a community with an extensive bicycle path system. A recent study of the resident's travel patterns found that 22 percent of the employed people surveyed typically ride their bike to work. 43 percent of students rode to school. In comparison, bicycle trips comprise less than 2 percent of travel in the Sacramento metropolitan region. The large use of bicycles in Davis illustrates the importance of safe facilities and the proximity of residential areas to commute destinations in encouraging higher rates of bicycle travel.

Pedestrians generally do not like walking between cars or crossing multiple-lane intersections; overhead or tunnel crossings can be used to further encourage walking near busy arterial roadways. For downtown streets, curb bulb-outs allow pedestrians to walk shorter distances in crossing streets. Walled residential communities actually encourage automobile use. Because there are no through-streets, pedestrians or bicyclists must take a circuitous route to get where they are going. Often, they will opt to take a car instead. These concepts are illustrated in the programs that follow this discussion.

Nationwide, 38 percent of all vehicle trips are for shopping or personal business. One half of these trips are less than five miles in distance. If the distance were shortened and half the trips were made on foot, total vehicle trips would lessen by over 5 percent.

One survey of suburban office workers found that about half left their building during the day. In an area with mixed-use, high-density development, 25 percent of trips were made on foot compared to 6 percent where services were not easily available. Using these figures, about 38 vehicle trips per day would be eliminated for a 100,000 square foot office building with 400 employees, if shops and services were within walking distance.

Increase Solar Access

Another way in which land use planning can reduce energy use is through subdivision designs that encourage solar access to buildings. Having sufficient solar access reduces the energy used for hot water heating and heating and/or cooling residences. Subdivision layouts should encourage lots with large southern exposures, which is the optimal siting for an energy efficient home. This topic will be discussed more in the section on Buildings and Energy Use.

Energy Conservation through Landscaping

Planting trees along streets reduces the heat absorbed by pavement and can therefore reduce the energy needed for cooling in adjacent buildings. Street trees also provide a more attractive environment for walking and bicycling and can increase property values.

Trees can not only help to cool the pavement outside homes and buildings, but can also be used to keep direct sun from entering buildings through windows (see the section on Building and Energy Use for more information). Plant leaves can block about 80 percent of the heat from summer sun that enters windows. The effective selection and placement of shade trees not only reduces carbon dioxide buildup, increases property value, and enhances community aesthetics, but shade trees also reduce air conditioning needs, especially in climates like the north county area which tend to be much greater. The use of deciduous shade trees provide further benefit in that sunlight will be able to reach the buildings in the wintertime, thereby reducing wintertime heating needs.

Transportation

According to the California Energy Commission (CEC), no other population in the world has embraced the automobile as passionately, nor is any other state defined as much by the car, as California. Roughly half of the energy Californians consume is for transportation. In 2006, Californians consumed an estimated 20 billion gallons of gasoline and diesel fuel on the state's roadways, an increase of nearly 50 percent over the last 20 years. Nearly 26 million registered vehicles operating in California produce about 40 percent of the state's greenhouse gas emissions.

Forty-eight percent of all the energy used in California is for transportation, and personal vehicles account for over 50 percent of all transportation energy use. Since 1973, transportation is the only energy use sector in which consumption has continued to grow in California (CEC, 2003). Energy conservation strategies for transportation attempt to decrease energy use through a variety of means.

The transportation programs discussed in this chapter can reduce vehicle fuel use by encouraging more people to walk or ride bicycles, use public transit, improve vehicle efficiency, use the railways rather than driving or trucking, use pipelines rather than boats, use telecommunication rather than driving or mail, reduce street widths, and plant trees. The overall objectives are to reduce the amount of fossil fuels that are burned and increase the efficiency of our transportation system.

Bicycles provide an energy efficient, clean, and inexpensive (relative to automobiles) form of transportation. Unfortunately many people do not use bicycles for transportation for several reasons, including but not limited to: 1) there may be no place to secure the bike when shopping or working, 2) streets are too narrow or dangerous for bicycles to share the roadway with

automobiles, 3) there are not showers and/or lockers available to allow a cyclist to change clothes after a long ride, 4) inclement weather may make biking uncomfortable or dangerous, 5) some trips such as weekly shopping may require carrying amounts or sizes of objects that are difficult to handle on a bicycle, or 6) for age and health reasons. Because of the long distances between bedroom communities and employment areas in San Luis Obispo, it is unlikely that bicycles will replace a significant number of automobile trips. If new job opportunities become concentrated within existing county communities, more residents will be able to walk or ride bikes.

The County Bikeways Plan identifies needed bikeway routes, accessory facilities such as bike parking, educational programs, and potential funding sources. The plan describes existing conditions in the county, the classes of bikeways and route selection process, and how bikeways fit into the transportation system among other issues. The County Bikeways Plan is available from the county Public Works Department.

Public Transit

Public transit is often viewed as a key component in reducing vehicle trips in and among cities. Mass transit and carpooling require certain population densities before they become feasible. A density of 12 dwelling units per acre is considered the minimum necessary to support bus routes (Calthorpe, 1990). Although an extensive public transit system is not available to residents outside of the City of San Luis Obispo, the county should consider present and future transportation needs in all planning efforts. For example, Paso Robles recently started transit service to downtown and other shopping centers.

Public transit needs will increase over the next 20 years as population increases. In particular, increased traffic volumes on the Highway 101 corridor between Paso Robles and Arroyo Grande will probably generate sufficient demand to support a bus line with the City of San Luis Obispo as the main hub. Incentives that may increase transit ridership include;

- make more routes to various destinations available,
- lower fees and costs to use transit systems,
- promote public transit through marketing and education,
- develop a rider friendly system with understandable schedules, comfortable transit stops and clear signage, and
- provide transit subsidies through employers and public agencies.

The Regional Transportation Plan recognizes public transit as a link that enables individuals to travel using a variety of modes that minimize automobile dependence. A goal of the plan is to provide reasonable and accessible region-wide public transit services to meet the mobility needs of all residents for access to essential services, educational, recreational, and

employment opportunities, and as a means to reduce air pollution, traffic congestion, parking problems, and fossil fuel use. Policies are focused on maintaining a minimum level of service; increasing convenience where feasible and cost effective; reducing air pollution, reducing cost where possible, and maximizing input from individuals, jurisdictions, and groups on all aspects of transit planning, evaluation, and service evaluation.

Vehicle Efficiency

Two critical aspects of vehicle efficiency that can be influenced by the county and the private sector include idling cars and older cars. Cars are least efficient when idling because they are consuming fuel at zero miles per gallon. Older and improperly maintained vehicles are not fuel efficient and pollute more than newer vehicles.

Alternative Fuels

Propane, methanol, ethanol, compressed natural gas, electric, and hydrogen powered cars are viable alternatives to traditional gasoline powered vehicles. New information about evolving fuel technologies will be available in the future. The following discussion highlights some of the features, advantages, and disadvantages of these vehicle technologies.

Propane. Propane is an alternative to gasoline for operating automobiles and trucks. It is cost effective to retrofit vehicles to enable them to use propane. Propane provides a travel range comparable to gasoline. It is more available and easier to handle than natural gas and reduces maintenance costs because it burns more efficiently.

Methanol. Often referred to as wood alcohol, methanol is commonly used as a blend of 85 percent methanol and 15 percent unleaded gasoline. Vehicles operating on methanol fuel can reduce emissions up to 50 percent relative to their gasoline counterparts. In addition, toxic emissions can be reduced by 50 percent (CEC, 1993).

Ethanol. Ethanol, or grain alcohol, is a high-octane fuel derived from corn and other biomass products. Ethanol is often used as a gasoline additive to boost octane. While this fuel has not been developed to the extent of methanol fuel, it can be produced from renewable resources, such as corn and other grains.

Compressed Natural Gas (CNG). Natural gas is the cleanest burning and currently least expensive fossil fuel for transportation. CNG vehicles can reduce carbon monoxide emissions by over 90 percent and organic gases by 35 to 45 percent. Natural gas is more readily available than other alterative fuels because of the extensive network for serving homes and businesses. Utilities are installing natural gas fueling stations in many parts of the state and several auto manufacturers are offering natural gas vehicles. The range for dedicated natural gas vehicles averages 200 miles (CEC, 1993).

Hydrogen. Hydrogen may also be an energy source for the future. It is a clean, efficient, plentiful alternative to carbon based fuels like oil and coal. Hydrogen can be made from several sources. Each molecule of water contains two atoms of hydrogen that can be extracted, stored, used as fuel and returned to the environment as pure water. Hydrogen can also be derived from natural gas and plant material. It can be used in internal combustion engines or combined with oxygen to power fuel cells to produce electricity. Barriers such as cost, safety, and lack of a distribution system are slowly being addressed through demonstration projects.

Electricity. Electric vehicles do not produce tailpipe emissions; they provide pollution reductions over gasoline vehicles even when the power plant emissions from generating electricity are considered. Electric vehicles are cost effective for short commutes, although long distance travel is still limited (about 60 miles). There are also some questions about the health effects of the electric and magnetic fields present in electric vehicles. Also, electric cars will increase the use of electricity. If electric cars create a large demand, this could lead to more powerplants being built.

Fuel Cells. Fuel cells are an experimental technology that uses a chemical process (similar to a battery) to produce energy. A fuel cell requires a continuous supply of hydrogen and oxygen. Hydrogen can be supplied either directly by an on-board hydrogen tank or indirectly by an on-board fossil fuel supply and reformer. A hydrogen fuel cell vehicle would have an energy efficiency about 160 percent greater than that of an internal combustion engine. For fuel cells powered by fossil fuel with on-board reformers, the only major emission would be carbon dioxide—at about 70 percent relative to gasoline powered cars. All emissions (both tailpipe and those used to create the hydrogen) could be eliminated if the hydrogen was generated from solar or wind energy.

Passenger and Commodity Railway Services

Trains provide a very energy efficient mode of transportation for both people and goods. The AMTRAK Coast Starlight provides stops in several cities including San Luis Obispo, Grover Beach and Paso Robles. Despite this relatively limited rail service, the Coast Starlight attracts heavy use from San Luis Obispo residents; an average of nearly 125 passengers board or depart on the two runs each day. A second daily train travels from San Luis Obispo to San Diego and back.

Local commodity movement on rails has declined because of an increasing emphasis on boat and truck shipping and centralized distribution facilities. Thus fewer and fewer industries continue to receive boxcar deliveries. In San Luis Obispo, trucks offer a faster and more flexible method of shipping goods, but trucks also consume more fuel and create greater demands on roadway improvements. The number of freight trains traveling through the county has remained fairly constant at two daily in each direction.

It should also be noted that some rail rights-of-way have been converted into trails. More information about this program is available from the Council of Governments.

Trucking Commodity Movement

In San Luis Obispo County, trucking movements account for 8 percent of the total vehicle traffic. Commodities carried by trucks cover a wide range of goods, with construction materials accounting for 36 percent and food and farm product accounting for 32 percent of the total (San Luis Obispo Council of Governments, 1993).

Streets

The construction of streets and the manufacturing of paving materials consume large amounts of land and energy. A narrower road will require less grading and less paving material and will leave more land open for residential development. (If separate bicycle lanes are desired in a roadway, the parking lanes should be made narrower or eliminated to accommodate a striped bicycle lane. This allows safe bicycle travel without increasing the road width significantly.) In hot climates, large amounts of pavement also increase the surrounding air temperature and create demand for additional energy use within nearby buildings for air conditioning (see Figure 3-6). Traffic calming measures in residential areas can decrease the speeds at which vehicles travel, reducing energy use and increasing safety. Using narrow roads and street trees can reduce the heat gain in homes from paved roads. In Santa Barbara, old toilets are recycled into chips for energy efficient paving material (CEC, 1992). To minimize the energy used in asphalt materials, tires or old asphalt can be recycled for use in new paving materials.

Telecommuting

Telecommuting allows people to minimize or eliminate the time/distance spent commuting to work. Types of telecommuting include:

- Home-based telecommuting involving employees who work at home and communicate with the main office by telephone, computer modem, and/or facsimile machine;
- Satellite business centers set up by a company to accommodate employees at a location closer to their homes than the main office. The satellite center is linked to the main office via telephones and computers, as well as video conferencing and long distance learning facilities; and
- Local/neighborhood telework centers which house telecommuters from more than one employer. Facilities can include computers, copy machines, telephones, secretarial services, meeting rooms, facsimile machines, and other equipment.

Employers that use large numbers of back-office clerical personnel would be the most likely to employ telecommuting or telework centers. Such employers could include California Polytechnic

State University, Cuesta College, the County of San Luis Obispo, the City of San Luis Obispo, Atascadero State Mental Hospital, the California Men's Colony, and Pacific Gas and Electric.

The evaluation of the costs and benefits of a California State telecommuting pilot project (200 participants) found that the program paid back its initial investment within three years. Benefits were significantly greater than the costs of training, phone/modem support, maintenance, and administration. Direct benefits included decreased sick leave, turnover, parking requirements, and needed office space.

ELECTRICITY GENERATION AND TRANSMISSION

This section covers electricity generation and transmission facilities in the county. The discussion is divided between facilities that operate on renewable fuel sources (such as solar, hydroelectric, wind, and biomass fuels) and those that operate on non-renewable fuels (such as uranium, oil, and gas). This is followed by a discussion of cogeneration facilities.

There are two utility-scale electricity generation facilities in San Luis Obispo County, the Morro Bay Power Plant and the Diablo Canyon Nuclear Power Plant. At the time of their construction, these power plants were sited and permitted by the state and federal governments. In the past, local governments have had little jurisdiction or ability to regulate the siting of large scale facilities. Two smaller gas and oil power plants in the county are classified as cogeneration facilities. A solar photovoltaic plant in the eastern portion of the county was dismantled ion the 1990's. Currently, as of 2008, there are proposals for at least three new solar power plants in the Carizzo Plains.

GENERAL FACILITY SITING

Any power generation facility development will result in some disruption of the natural environment. There are some areas that the Coastal Commission has specifically identified as unsuitable for future power plant construction. There are some issues that are common to all electricity generation facilities. In particular, three issues often arise in the siting of generating facilities. These areas of concern are: compatibility with surrounding uses, site disturbance, and cooling water availability.

Compatibility with Surrounding Uses

Energy conversion power plants (facilities that use a natural resource such as gas, oil, or uranium and convert it to electricity) are generally industrial-type land uses. Such facilities may generate excessive heat, noise, and/or odors that can be offensive or hazardous to downwind populations. Conversion facilities should generally be located in areas suitable for industrial development and away from sensitive land uses such as residential, commercial, or recreational areas, and sensitive wildlife habitats.

Site Disturbance

Construction and operation of electricity production facilities necessarily disturb the sites they occupy. A common objection to facilities is the visual impact on the surrounding landscape. Excessive grading and land disturbance can result in erosion problems that are difficult to rectify. Loss of habitat or other wildlife impacts may be significant. Noise is sometimes a consideration as well.

Cooling Water

Some energy processes (solar thermal, biomass combustion, fossil fuel, uranium) convert heat into electricity by using steam or some other substance to turn a turbine. Cool water is typically needed to condense the steam and turn it back into water so that the cycle can be repeated. A reliable supply of cooling water is therefore a constraint on thermal facilities. Monitoring the impacts cooling water has on biological communities when it is returned to its source is an important activity. The exact amount of water use will depend on the type, size, and efficiency of the facility. Therefore, the availability of water and the relative merit of competing uses is an issue in the siting of thermal electric facilities.

THE FUTURE OF ELECTRICITY GENERATION

All electric utility providers are required by state law and the California Public Utilities Commission to maintain a reliable and least costly supply of electricity to the rate payers in their district. Many utility companies anticipate that the future of energy production will change from dependence on large centralized power plants to reliance on smaller, more localized producers. Instead of building large power plants, smaller units that meet the need of the locale or region will be installed. In this scenario, a variety of facilities and sources will likely be used, rather than relying on one technology. For example, the energy mix of the future could include solar systems, wind energy conversion systems, hydroelectric, biomass, cogeneration, advanced steam turbines, advanced gas turbines, and fuel cells.

This new approach of the future would require that utility providers work together with state and local regulatory authorities to:

- Consider a full range of resource alternatives, including, in preferential order:
  1) conservation and efficiency,
  2) renewable energy supply resources.
  3) cogeneration and last, and
  4) high efficiency fossil fuel facilities.
- Consider and monitor regional needs and plans in relation to regional and global environmental impacts;

- Evaluate resource alternatives on a consistent basis, quantifying features of cost, environmental impact, diversity, risk, reliability, and long-term economic benefit;
- Implement regulatory reforms such that a utility's resource plan is its least-cost course of action and is also its most profitable course of action. At a minimum, utilities' prudent investment in conservation and efficiency measures should be profitable, but not at the expense of public health and safety.
- Develop alternatives to traditional rate structures which permit utilities to have reasonable opportunities for profitability in a more competitive environment while continuing their resource planning programs.
- Write an action plan to ensure appropriate research and development expenditures, sustained orderly development of resource bases, and monitoring and evaluation protocols to check progress.
- Periodically evaluate the results in light of the action plan.

The future may bring a variety of electricity generating facilities that are smaller in scale and located closer to end users of power. Local agencies may be responsible for permitting and siting these facilities. By encouraging the development of renewable, local sources of energy, we can enhance the overall environmental and economic quality of the county. The following policies, guidelines, and programs will help prepare the county for dealing with a variety of different electricity projects.

Electric and Magnetic Fields

Wherever electricity is used, electric and magnetic fields are present. Because there is a relationship between electric and magnetic fields they are often termed electromagnetic fields (EMF). Wherever there is a flow of electricity, both electric and magnetic fields are created. Examples include appliances, lighting, and other electrical uses in homes, schools and work places. Transmission and distribution lines which transport electricity also produce both electric and magnetic fields.

Electric fields are created by voltage, and higher voltage produces stronger electric fields. An electric field exists near any line that carries electricity and any appliance that is plugged into an electrical outlet. Electric fields are measured in volts per meter (V/m). The intensity of electric fields is directly related to the amount of voltage flowing through a conductor and the distance from the source of the field. Electric fields can be shielded by objects and materials.

Magnetic fields result from current flowing through wires from one place to another. Magnetic fields are typically measured in gauss. Milliguass, one-thousandth of a gauss, is the measurement used most often when fields are evaluated. The strength of a magnetic field depends on the amount of current flowing through, and the configuration of, the conductor(s). A

conductor can be a transmission line, an electric cord from an appliance, or any other device that conducts an electric current. Magnetic fields pass through most objects or materials, but their magnitude decreases rapidly with distance.

The health effects of electric and magnetic fields on humans are not clear. Some studies have suggested that an association between EMFs and certain cancers may exist. Other studies have shown that various cellular activities are affected by EMFs. The findings of many studies have been controversial, with no clear identification of a cause-and-effect relationship.

The question about the health affects caused by EMFs has yet to be conclusively answered. According to the California Department of Health Services, a number of research studies are underway to determine if EMFs pose health risks, and, if so, what aspect of the field is harmful. However, enough scientific information links them with health affects that taking measures to avoid exposure is warranted.

The present California Energy Commission approach to 60 Hz field control is to ensure that public exposures to fields from future transmission lines do not exceed those associated with the presence of existing lines. The present standard is to limit the strength of the electric field to 1.6 kilo volt per meter (kv/m) at the edge of the line right-of-way.

Renewable Fuels

This section discusses the technology, available resource, and siting issues associated with solar energy conversion systems, biomass combustion facilities, wind energy conversion system, and hydroelectric facilities. In general, the county favors the use of such resources over the use of fossil fuel facilities.

Solar Energy

When speaking of "solar energy technology", we are referring to the direct conversion of sunlight into usable energy. Sunlight can be converted to electricity, or used directly to heat water or space. Some issues associated with solar space lighting and water heating were discussed in the previous chapter on Buildings and Energy Use.

The two major types of solar energy technology that generate electricity are photovoltaic and solar-thermal facilities. Photovoltaic solar facilities directly convert sunlight into an electrical current at a low voltage. Photovoltaic solar cells absorb sunlight and converts it directly to electricity through the reaction of electrons within the cell. Electrical current can then be withdrawn from the cell and stored in batteries, used on-site, and/or fed into transmission lines (after being converted from direct current to alternating current in most cases).

Solar thermal technology first collects and concentrates solar energy and then converts the energy into electricity. Most commonly, a highly reflective surface is used to focus solar energy on a heat collecting pipe (called the "receiver"). A fluid circulates through the receiver, collecting

the thermal energy and transferring it to the power block of the plant for the generation of electricity. If the fluid is water/steam, then the fluid is used to drive a turbine directly. If the fluid is a heat transfer material, such as oil or liquid sodium, then the fluid transfers its heat energy to water to make steam in a heat exchanger, called the steam generator. Methods used to concentrate sunlight include 1) parabolic dish mirrors, 3) mirrors arranged in parabolic troughs, or 3) distributed mirror array focused on central receiver system.

Solar energy boasts the largest resource potential of any energy source in the county. In particular, the Carrizo Plains is a unique solar. It is one of two potential locations in California that do not get coastal fog during the summer or ground fog during the winter. The only other area in California with greater solar potential is the Mojave Desert.

The amount of sunlight that could be collected and converted into energy is constrained only by the economics of building large energy conversion plants and the efficiency of such facilities. Even so, it appears that more than enough solar energy could be generated to satisfy the county's need for electricity.

Photovoltaic and passive solar systems are relatively small and extremely reliable, do not require cooling water, require little or no maintenance, and are located near the load they serve. This avoids transmission impacts, and site impacts are minimal. Water pumping, grid voltage support, and power for remote locations off the grid are examples of photovoltaic system use which may be appropriate for San Luis Obispo County. Passive solar applications and designs can be used on any new or existing structure.

The solar resource available in the Carrizo Plains gives San Luis Obispo County the opportunity to make a bold statement regarding the development of renewable energy facilities. The county may be able to accelerate that time line by providing clear guidelines, procedures, and possibly incentives for the development of such a facility. Likewise if photovoltaic-technology efficiencies improve, a large-scale photovoltaic facility may also be feasible on the Carrizo Plains.

The Carizzo Plains supports several rare or threatened species including the San Joaquin Kit Fox. Installation of large solar facilities could have a negative effect on the kit fox and its habitat. The most careful review of development applications is needed in this area due to the conflict with endangered resources.

Biomass Fuels

San Luis Obispo County has a sizable amount of biomass potential (2.9 trillion Btu/yr). There are two biomass facilities in the county as shown on Figure 4-4. These facilities are part of cogeneration systems and are discussed later in this report.

Biomass refers to various organic waste products from agricultural and industrial processes. When using biomass materials that would normally enter municipal landfills, the process is often

called waste-to-energy conversion. The most simple biomass conversion facility is the typical fireplace, furnace, or wood-burning stove. The wood is burned to provide space heating. Although simple, and often aesthetically pleasing, this form of biomass conversion uses a fairly high-grade fuel source (dry wood) and can sometimes be an inefficient heating mechanism.

More complicated biomass thermal conversion techniques involve burning flammable materials to boil water and generate steam, which then drives steam turbine-generators to generate electricity. Waste products with higher moisture content, such as animal manure and wastewater treatment sludge, can often be used in modified steam boilers. Mass burn systems use minimal processing of the waste prior to incineration. Large-scale mass burn systems typically have capacities up to 3,000 tons per day of municipal solid waste. Small scale mass burn systems typically use less than 500 tons per day and are ideally sited to small communities of 25,000 to 250,000 people.

Another thermal conversion technique is gasification, also known as pyrolysis. Pyrolysis exposes a biomass source to high temperatures while limiting the amount of oxygen. A second method uses biological methods to create biogas. The municipal waste is placed in a chamber where anaerobic digestion (the bacterial digestion of organic materials in the absence of oxygen) produces biogas. (Liquefaction is another type of gasification where the final product is a liquid fuel instead of gas.) The biogas can then be 1) captured and used directly like natural gas, or 2) burned to drive steam turbines which then generate electricity.

When siting a biomass facility, collecting the fuel is the main issue of concern. To efficiently collect livestock manure for use as a biomass fuel, 50 to 80 percent of the animals must be confined within a relatively small area; dairy farms, feedlots, and chicken farms in the area may best meet this requirement. For example, the proposed chicken farm in the north county area and the feedlots at California Polytechnic State University for cattle, pigs, sheep, and chickens may be good candidates for biomass conversion facilities (Williams, personal communication). The biomass facilities may even benefit from a cogeneration facility.

Almost any sort of biomass can be burned to produce heat, steam, and electricity. The direct combustion of biomass however, results in pollutant emissions such as nitrogen oxides, reactive organic gases, and particulates. The problem may be particularly severe for facilities burning raw municipal wastes, which can contain toxic ash that must be safely disposed of.

Waste-to-energy facilities tend to be more expensive than some other forms of electricity generation, but they have the added benefit of extending the life of municipal landfills. Biomass may become a more attractive option for energy conversion in the future as state waste management standards take effect. AB 939 requires that 25 percent of wastes be diverted from municipal landfills by 1995 and 50 percent be diverted by the year 2000. The 25 percent reduction can probably be achieved through recycling and consumer education programs. To achieve the 50 percent reduction goal, the county will probably have to institute a composting or

waste-to-energy conversion program. However, the requirement needs of the waste-to-energy facility should not allow burning wastes such as paper, newspaper, and cardboard.

Wind Energy

San Luis Obispo County has only a few areas suitable for large scale wind energy conversion system (WECS) development. Wind turbines consist of blades, rotor, transmission, electrical generator, and control system, all mounted on a tower. Wind causes the blades to rotate, generating mechanical energy that is converted to electrical energy by a generator. The blades of most wind turbines rotate in a vertical plane (horizontal axis), although some wind turbines rotate about a vertical axis. Most wind/electric turbines have either two or three blades made of fiberglass, laminated wood, or aluminum. These blades are mounted on tubular or lattice towers. Wind turbines may be connected to a utility grid system as single units or grouped into arrays.

There are numerous advantages to wind-generated power: the generators do not emit pollutants to the air or to water resources; water is not needed in the production cycle; and the machines are preassembled and can be installed relatively quickly.

Some individuals may elect to purchase a small-scale wind generator for private use. Wind energy could also be used for pumping water on a more widespread basis. Some individual applications may be successful in the areas with wind speeds of 11 miles per hour or faster. The monthly kilowatt hours on some generator models may be sufficient to power an agricultural pump or a home or small business.

At excellent sites, commercial wind generation has the potential to provide the lowest cost energy of all renewable resources (PG&E 1992). Unfortunately, there are no excellent sites in San Luis Obispo County, i.e., wind speeds averaging around 18 miles per hour. The only appropriate area for large-scale wind farm development is the coastal area between Point Buchon and Point San Luis. (In other locations with high wind speeds, the scenic values of the areas outweigh the possible benefits of wind power development.) There are still a number of constraints at this site:

- There are a number of archaeological sites that may limit the number of suitable locations for wind towers.
- Given the current state of wind energy conversion technology, the site is only moderately suitable for large-scale wind generator development.

If, as suspected, there is unidentified potential in the remote areas of the Paso Robles/Salinas Valley area, such locations may be more appropriate for WECS development. Aesthetics along the Highway 101 corridor will be an important consideration in permitting any wind towers.

If the technology improves to the point where large-scale wind farm development is practical, the county should carefully consider any large-scale wind energy conversion systems requests.

Hydroelectric Energy

Existing hydroelectric facilities on reservoirs include Lopez Lake, Lake Nacimiento, Whale Rock Reservoir, and Santa Margarita Lake. San Luis Obispo watercourses with hydroelectric potential include the Salinas River, Santa Margarita River, and San Luis Creek. Stenner Canyon is also the site of a facility. The state water project may include one hydroelectric facility near the base of the Cuesta Grade.

Hydroelectric facilities utilize the energy of moving water. Most facilities use a dam or diversion structure to control water so that, as the water falls, it turns a turbine. The mechanical energy associated with the movement of the turbine is then converted into electricity via a generator attached to the turbine. The water must have sufficient energy to move the turbine (called "hydrostatic head"). For this reason, most large-scale projects are located at a dam or reservoir where the hydrostatic head can be confined to a compact area. Smaller scale projects can be sited along streams or inside water pipelines coming down steep hillsides, where hydrostatic head is created by the natural change in elevation.

Impacts of hydroelectric projects are related to the construction of dams and the diversion of water from existing riparian corridors. In San Luis Obispo County, dams and diversions are primarily to augment water supplies, not energy. When energy can be captured incidentally (e.g. in-pipe systems) from the operation of water facilities, it has few, if any, additional impacts.

Such hydroelectric facilities may impact hydrology by: changing stream flows; changing the amount of groundwater recharge; affecting water turbidity (the amount of sediment in the water) and oxygen content; and altering water quality and quantity, thereby adversely impacting aquatic life. Hydroelectric facilities are generally located on steep, visible slopes to take advantage of hydrostatic head. This may require converting a free flowing natural stream landscape to an industrial-looking facility.

Geothermal

Historically, San Luis Obispo County has made direct use of geothermal energy from hot springs located near Paso Robles and Avila Beach. The county's geothermal energy could be used as a supply of low temperature heat in areas like Paso Robles. Such systems would have minimal impacts so long as the mineral content of waste water from the system is carefully evaluated. In some instances, geothermal fluids may have to be reinjected into the geothermal reservoir.

NON-RENEWABLE FUELS

This section discusses steam generating power plants, fuel cells, high efficiency combustion turbines, and hydrogen.

Steam Generating Power Plants

Steam generating power plants generally use oil, gas, coal, or nuclear fuels. (Coal facilities are unlikely in the county and are therefore excluded from this discussion.) It is the position of the county to discourage the use of non-renewable fuels and encourage energy efficiency, conservation, and the development of renewable energy resources.

Steam generating power plants convert heat into electricity by burning or otherwise releasing energy from the fuel to create heat which is then used to create steam. The steam is then used to turn a turbine which creates the electricity.

The two utility-level electricity generation facilities in San Luis Obispo County are the Morro Bay Power Plant and the Diablo Canyon Nuclear Power Plant.

Morro Bay Power Plant. The Morro Bay Power Plant is located in the City of Morro Bay and was constructed shortly after World War II to meet the increased demand for electricity caused by incoming California residents. There are a total of four generating units at the site, with a combined output of 1,002 MW. The first two units began producing electricity in 1955 and 1956 and have a maximum output of 163 MW each. The third and fourth units began to operate in 1962 and 1963, respectively. These two units have a maximum output of 338 MW each. The Morro Bay power plant primarily burns natural gas, although it can use fuel oil if necessary. At full capacity, the units use 146 million cubic feet of natural gas or 1.4 million gallons of oil per day. The plant now operates at only 5% capacity.

Up to 492 million gallons of water are pumped out of Morro Bay each day and used to cool the steam that drives the turbines. The water is constantly flowing and this once-through system creates a steady stream of heated water that enters Estero Bay north of Morro Rock. The Morro Bay Power Plant also has desalinization facilities to provide water for the steam generation cycle, with a capacity for purifying 324,000 gallons of water per day.

Diablo Canyon. Construction of the Diablo Canyon Power Plant began in 1967 and the plant began operating in 1986. It is currently (2006) the largest energy facility in the county with a production capacity of 2,160 MW.

The Diablo Canyon facility has two reactor vessels. Each vessel is inside a dome-shaped containment structure that stands 215 feet high and has a diameter of 147 feet. The facility uses a system of three water loops that do not come into direct contact with one another. The primary loop passes water through the reactor core to be heated. The water is under high enough

pressure to prevent boiling, even though temperatures exceed 600 degrees. Before being recycled back through the reactor core, the water in the primary loop transfers its heat to the steam generator in the secondary loop. Here, water in the secondary loop is allowed to boil, creating steam. This steam is piped to the turbine-generator building, where it spins the turbine-generator to produce electricity. The steam is then cooled by the water in the condenser loop and recycled back through the steam generator. The condenser loop continually draws water from a small inlet cove and discharges into a larger cove once it has been circulated through the loop. The discharged water is slightly warmer than the surrounding ocean water.

To support the purified water needed for the primary and secondary loops, Diablo Canyon has a sophisticated desalinization system. The plant has the capacity to process 648,000 gallons of ultra-purified water per day for peak period use. Some of this water is used for general plant operations to support the employees at the plant. The saline solution remaining after desalinization is injected into the outfalls along with the ocean water used in the condenser loop.

As mentioned previously, steam generating power plants require large amounts of water for conversion into steam and for cooling the combustion or fission processes. Air emissions from fossil fuel plant operations, can present problems. Burning oil results in significant air pollution emissions; natural gas burns cleaner, but still emits some pollutants. San Luis Obispo County is a non-attainment area for ozone and particulate matter, and the siting of new and/or expanded facilities must take potential emissions into account. Development of new or expanding existing facilities could result in both short-term and long-term increases in air emissions.

Radioactive wastes from nuclear facilities present especially difficult disposal problems. Transporting such wastes over any distance increases the potential for accidents and radiation exposure. With regard to pollutants and waste management, the project must comply with all applicable federal, state, and local laws, ordinances, regulations, and standards for non-hazardous and hazardous waste. Currently, radioactive waste is stored at the power plant in the spent fuel storage pool. The water in the pool acts as a radiation shield and coolant. This is meant to be a temporary storage situation until a permanent disposal site is found and approved by the federal government. The DCPP recently received permission form the Nuclear Regulatory Commission to transfer radioactive waste from the spent fuel pool to above ground “dry casks”. These casks will be stored outdoors on a concrete pad above the power plant for an indeterminate period of time.

Finally, steam generating power plants are generally relatively large, industrial-type land uses that may be aesthetically unpleasant. For these reasons, such facilities should generally be located in areas suitable for industrial development and away from sensitive land uses such as residential, commercial, or recreational areas, and sensitive wildlife habitats.

Fuel Cells

Fuel cells operate much like a battery, by transforming chemical energy into electrical energy directly, without a combustion process. Fuel cells require a continuous supply of hydrogen and oxygen. The cells produce direct current, which then must be passed through an invertor to create alternating current. Fuel cells are not yet commercially available, but they are expected to be a viable technology in the near future. The expected efficiency of these systems is about 40 percent. Fuel cells supplied directly with hydrogen and oxygen would produce no emissions. When a fuel other than hydrogen is used (for example, methane or methanol can be used in conjunction with an on-board reformer), there will be carbon dioxide emissions, and there could be very low levels of hydrocarbons, carbon monoxide, and nitrogen oxide emissions.

Because fuel cells could have no harmful emissions, small units could be established in individual neighborhoods to directly service the surrounding area. This would minimize transmission facilities and the energy lost through long-distance energy transmission.

High Efficiency Combustion Turbines

New technologies provide more efficient means to generate electricity from fossil fuels through advanced combustion turbines, including steam injected gas turbines, reheat gas turbines, and chemically recuperated gas turbines. As they are perfected, these technology advances are expected to permit electricity generation efficiencies of 55 percent or higher, compared to older utility power plants that typically operate in the 30 to 34 percent efficiency range.

Steam Injected Gas Turbines. In this technology, steam is injected directly into the gas turbine along with the air and fuel. Heat from the combustion exhaust system is captured and used as part of the heat input, thereby increasing the efficiency of the combustion system. The steam-injected gas turbine has a typical efficiency of about 44 percent and nitrogen oxide emissions are 70 percent lower than in simple cycle gas turbines. These commercially available gas turbines can be used in cogeneration applications.

Reheat Gas Turbines. In this technology, two combustors are separated by a first-stage turbine wheel. Fuel is ignited in the upstream combustor to drive the turbine wheel. Hot gases leaving the first stage are reburned by self-ignition as additional fuel is injected into a second, downstream combustor. Combined, sequential combustion drives the remaining turbine stages. When coupled to a heat recovery steam generator and a steam turbine (i.e., in a combined cycle configuration), this commercially available system can achieve a net efficiency of 57 percent.

Chemically Recuperated Gas Turbine. In this technology, a chemically treated, hydrogen-rich fuel (reformate) is burned to produce power. The gas turbine exhaust energy is used both in the reformer and in the steam generator, thereby increasing the efficiency of the conversion process. When combined with the intercooling and reheat system, it is expected that efficiencies

would be greater than 55 percent. The fuels inherently have very low nitrogen oxide and carbon monoxide concentrations, so pollutant emissions are greatly reduced.

Hydrogen

Hydrogen appears to be an extremely attractive fuel for the future. It can be made from plentiful, renewable resources such as sunlight and water, and it produces only water vapor and small amounts of nitrogen oxides when burned. Hydrogen's flexibility in form and function make it usable to meet any energy need—from combustion devices to fuel-cell electricity producers. But, the hydrogen concept still presents three challenges to the energy research and development community:

- Development of renewable production technologies that are economical and capable of industrial-level production.
- Development of storage techniques that are competitive with conventional fuels in terms of weight and volume.
- Broad introduction into a vital energy sector-preferably transportation (Melody, 1993).

Hydrogen gas can be produced from biomass by electrolyzing water using electricity from photovoltaics, solar thermal collectors, or wind generators. The hydrogen could then be used in place of natural gas to power cars, homes, offices, and factories.

Cogeneration

Cogeneration facilities are not a method of energy conversion, but rather a method of energy efficiency. Industrial applications of cogeneration facilities typically take one of two forms. They use the heat left over from the process of generating electricity for another purpose (called a topping cycle). For example, the excess heat left over from running a steam turbine could be used directly to manufacture glass. The second basic principle uses the heat left over from an industrial process, such as food processing, to generate electricity (called a bottoming cycle). Figure 4-9 diagrams the various cogeneration processes.

Sometimes both a topping and bottoming cycle can be sequentially combined (called a combined cycle) in an electricity generation facility. Waste heat from the primary generation process is sent through a second turbine to create additional electricity. Such facilities are most economical and efficient when the fuel source is one that would otherwise be wasted, such as gas captured from sewage treatment facilities.

There are three cogeneration facilities in San Luis Obispo. San Luis Obispo's California Polytechnic State University power plant is a cogeneration facility with a capacity of .35 MW. A converted diesel engine burns natural gas to drive a generator for electricity. Heat from the engine's exhaust system is channeled to a steam boiler and used for dormitory space heating

and hot water heating (topping cycle). In Nipomo, Koch California Ltd. owns another cogeneration facility that can generate up to .30 MW. Koch uses a natural gas-powered generator to produce electricity which it then sells to PG&E as a Qualifying Facility. The cooling water is then used to heat greenhouses (topping cycle).

The third biomass cogeneration facility is owned and operated by the city of San Luis Obispo at the Water Reclamation Facility. The facility uses an anaerobic digester to create methane gas from sewage. The methane gas is then burned to generate electricity for the facility. The waste heat from the electricity generation is used to keep the anaerobic digester warm (Marks, personal communication). This is an exemplary use of a cogeneration facility, as it uses waste products for fuel.

The enhanced oil recovery operations in the county are also considered cogeneration facilities. The wells in the Price Canyon Oil Field are equipped with enhanced oil recovery systems. Enhanced oil recovery methods boost production levels by burning gas (sometimes associated gas) to create steam. The steam is then injected back into the well. The heat from the steam lowers the viscosity of the heavy crude so it will flow more easily. Because of the large energy use required to create the steam (which can be very expensive) and the limited increase in production levels, enhanced oil recovery is used on a limited basis (only when gas and oil prices make it profitable).

Facility Siting

The basic idea behind cogeneration facilities—shared energy use—means that such facilities are best located at the point which can use the waste heat, the electricity, or both. Large institutions, agriculture sites and enhanced oil recovery sites have the most potential in San Luis Obispo County. Because cogeneration facilities are most often added on to existing operations, the type and extent of potential impacts are dependent on the individual project and are not easily generalized.

However, in almost all cases, the facility will need to be tied into the utility grid to store or transmit electricity; therefore, the same types of impacts associated with transmission lines may occur. But, in many cases, cogeneration facilities can be installed with few new impacts beyond those associated with the original land use. Cogeneration facilities that are designed as an integral part of a new industrial plant or operation can also be designed to have no significant impacts beyond those normally associated with the industrial operation itself.

Most proposals for cogeneration facilities will probably generate less than 50 MW in San Luis Obispo County, and will therefore require no special state or federal permits. This means that the county will have the authority to permit all aspects of such facilities. In most cases, installation of cogeneration components at existing industrial, agricultural, or power generation

facilities are generally categorically exempt from CEQA processing. This provides the county the opportunity to encourage cogeneration facilities by simplifying the review process.

Distributed or Small-scale Utility

The concept of a distributed utility is a departure from building large scale, centralized power plants and extensive transmission lines to deliver electricity. The idea is to have more, smaller power generating and storage facilities that are located near the end users. These types of facilities produce electricity closer to where it is needed, thereby deferring or avoiding the need for new or upgraded transmission and distribution lines.

Electric Transmission Lines

Electric power lines require right-of-way easements to cross over privately owned lands. Such easements are negotiated directly between project proponents and land owners. Although shorter routes are generally preferable from an environmental, engineering, and economic perspective, regulated utilities take other issues into consideration when selecting power line routes. These issues include geology, terrain, surrounding land uses, aesthetics, local policies, public roads, private access roads, owner's uses and concerns, and service to the public. Electric power lines should be located near energy loads in order to maintain system reliability and minimize drops in electric voltage which occur over extended sections of distribution lines.

Underground installation of transmission lines is technologically possible, but the excavation required for underground lines and associated transition stations may result in significant environmental impacts. Easement widths for underground transmission lines are generally larger and greater land use restrictions may be necessary for underground lines to ensure access when necessary.

Transition stations (typically half an acre) are required where underground lines connect to overhead lines to provide for safe transmission of the power between the lines. To date, most transmission and distribution lines are placed above-ground because it is significantly less expensive.

Substations include equipment that switches, changes, or regulates voltage in the electric transmission and distribution system. Located at major junctions throughout a utility system, they can increase (step-up) the voltage at which power is transmitted, or substations can decrease (step-down) voltage near load centers such as communities or large customers.

There are seven electrical transmission line corridors within San Luis Obispo County. Four of the lines transport electricity generated from the Morro Bay Power Plant. Two other transmission line corridors originate at the Diablo Canyon Power Plant. The remaining transmission line corridor originates in San Joaquin Valley and enters the Carrizo Plains near Soda Lake.

Power lines cause significant visual impacts. Property owners may feel that such lines and towers decrease real property values. Power lines may also interfere with agricultural operations by preventing creating hazards for aerial spraying. Additionally, agricultural production on land beneath power lines can be reduced if towers and poles interfere with the operation or maneuverability of farm cultivation equipment. However, the type of power line and towers used near agricultural areas can mitigate some of the impacts of new power line construction.

FOSSIL FUEL PRODUCTION

This chapter discusses fossil fuel facilities in the county, including oil and gas wells, separators, and refineries. Although some natural gas is pumped from local wells, this product is generally treated and transported with the crude oil resources.

Oil and Gas Wells Production and Processing

Surface exploratory methods bring in equipment for a short time, complete the exploratory drilling, and then remove the equipment. Therefore, most exploratory methods do not have a permanent impact on the change in land use. However, exploration methods can have significant, short-term impacts.

Permanent well sites are constructed by installing a pipe (called casing) in the well, and then pouring concrete between the casing and the well wall. If the oil or gas zone has sufficient pressure to be produced without pumping, a series of valves, attached to the tubing and casing will regulate the rate of oil or gas flow.

As gas and oil are extracted, conditions change within the oil reservoir and production levels generally start to decline. Enhanced oil recovery methods boost production levels by using pressure, heat, and/or chemicals. The most common enhanced oil recovery method used in California is to inject steam into the wells. The heat from the steam lowers the viscosity of the heavy crude so it will flow more easily.

A method of drilling that can minimize the impacts of production wells is called horizontal or extended reach drilling. Oil and gas reservoirs can be tapped by a bore hole that travels horizontally through the geologic formation instead of straight down. This can lead to fewer production wells being sited to produce the oil and gas. This technology has been proposed to produce oil and gas from both inland reservoirs and those located in nearshore coastal waters, from onshore production sites.

Once oil reaches the surface, it is pumped to a facility near the well that separates the oil, gas, and water. After separation, the crude oil is stored in nearby stock tanks and the gas is routed into lines leading to a gas plant for further processing. The water is either filtered and used for steam injection or water flooding, or it is pumped into a disposal well. In the past, oil production

sumps were typically depressions in the ground used to separate oil and water or store produced fluids. In San Luis Obispo County, tanks or a protected sump must be used.

After the crude oil leaves the field separator, it is further dehydrated in order to reduce its water and sediment content to a maximum of one percent. The crude is then transported to refineries via truck, pipeline, or ocean tanker.

This topic is further discussed in the following section on transmission facilities. The refining process is usually accomplished by applying large amounts of heat to the crude oil. Crude oil, heavier gas liquids, or crude oil components are refined through a boiling or fractionating process that splits the product into liquids of different boiling ranges (or fractions) by distillations.

As the crude is boiled, those products with the lowest boiling rates are butanes (natural gas) which is generally sent to a gas processing plant for further refining. The second group of products to reach boiling point are called "light end" products and include gasoline and naphtha. (Light products, primarily gasoline, constitute more than 50 percent of the petroleum product consumed in California.) The next group of products to reach boiling point are distillates, such as kerosene, diesel, and jet fuel. (Distillates provide for about 30 percent of fossil fuel demand). The remaining substance are heavy products such as heavy gas oil and residual fuel, which can be used for asphalt and other specialties.

Siting and Operation of Facilities

The potential for siting new oil and gas facilities in San Luis Obispo County raises serious environmental and political issues. In general, siting criteria should address land use, air quality, sensitive biological resources, geologic hazards, and hazardous materials management. Other equally important considerations are hydrology, noise, cultural resources, and emergency services, but these issues are specific to the proposed site and use (rather than a question of general location) and are best addressed during project level review.

Land Use Conflicts. One of the key land use issues related to siting of new or expanded facilities is compatibility of the facility with adjacent uses. Compatibility should consider nuisance factors, such as noise, dust, odor, traffic, light and glare, and potential impacts to visual resources and aesthetics.

One way to minimize land use conflicts is to consolidate facilities allowing all producers to share pipelines, processing facilities, and (to a lesser extent) marine terminals. The facility owner must provide equal access and rates to all producers using the facility. It is even possible for producers to share a well field site or production and transportation equipment.

Air Quality. San Luis Obispo County is a non-attainment area for ozone and particulate matter, and the siting of new and/or expanded facilities must take potential emissions into account.

Development of new or expanding existing facilities could result in both short-term and long-term increases in air emissions.

Sensitive Biological Resources. San Luis Obispo County spans 96 miles of coastline and has many areas with important habitat, recreational, and agricultural resources; those areas include the lands surrounding Nipomo Dunes, the north coast areas, and the Morro Bay watershed (San Luis Obispo County, 1992). Both the county's onshore and offshore biological resources could be affected by oil and gas exploration, construction, and production activities, especially oil spills. Any new or expanded support facilities should be sited to avoid biologically sensitive areas.

Geologic Hazards. Geologic hazards in the county that could impact energy facilities include earthquakes, landslides, subsidence, erosion, and soil expansion. In general, facilities should be sited at least 200 feet away from active or potentially active faults and should avoid slopes of 20 percent or greater. Site-specific geotechnical studies and specially designed building foundations can be used to mitigate potential impacts associated with subsidence and expansive soils.

Hazardous Materials Management. Hazardous materials are used, stored, and/or produced by the petroleum industry. The local health department monitors the hazardous materials used and stored throughout the county. The Fossil Fuel Issues Working Paper provides a list of federal and state regulations applicable to fossil fuel facilities in San Luis Obispo County. Refinery Operations

Because of the proximity of residential development to the Santa Maria Refinery, refinery operations and air emissions are a highly visible and publicized problem. However, there is no practical way to deal with the issue of residential proximity (aside from improving plant emissions and safety) because relocating the facility or establishing a new one is probably infeasible.

Abandonment

San Luis Obispo County has numerous oil-related facilities, including storage facilities, oil pipelines, pump stations, and oil fields that are no longer in service, and other existing facilities will continue to be phased out, such as processing facilities and marine terminals. Older sites may have unsafe structures or concentrations of hazardous products on-site. Most permits prior to 1960 did not set forth proper and timely abandonment requirements at the termination of the operation. For new facilities, an abandonment plan should be considered as part of the application. The issue of abandoning and decommissioning facilities should be studied further. Future policy development should be based on an understanding of the various issues involved in abandoning facilities and coordination with other agencies.

DECOMMISSIONED OIL FACILITIES

Marine Terminals	Oil Fields	Pipelines
Chevron Estero	Guadalupe oil field	Chevron Rio Bravo line
Morro Bay Power Plant		San Ardo line
US Navy (Estero)		Pump stations

Transporting Petroleum Products

Oil that has been produced (extracted from the ground) must then be transported to a refinery. The transportation options for petroleum products are either pipelines or marine terminals and tankers. Oil spills from tankers and marine vessels represent a sewage risk and significant harm to the marine environment; tanker accidents, tanker operations, and other vessel operations account for 45 percent of the total input of petroleum hydrocarbons going into the California marine environment (CCC, 1993). It should be noted that in 1993, the U.S. Navy was responsible for 82 of the 177 (46%) spill incidents in California (OSPR). Spills are most devastating when they leak directly into the marine environment. Oil spills can also occur as slow pipeline leaks into soils and groundwater.

Marine Terminals and Tankers

Marine terminals are used to load and/or unload crude oil or refined products onto, or off of, tankers. A terminal is made up of various components, including onshore tankage, pumping machinery, a network of pipelines and hoses, mooring systems, and oil spill response materials.

There were four marine terminals in San Luis Obispo County. Millions of barrels of petroleum materials are transferred through these facilities each year. At Estero Bay there were three operating marine terminals. Chevron operated two terminals to load crude and product, and the U.S. Navy had a terminal that was used to unload product.

Pipelines

Although pipelines pose less risk of spills than tankers, there are still significant impacts associated with pipeline development. The serious affects of a spill can be minimized by automatically shutting down the pipeline system, then promptly repairing the damage and cleaning up the spill. If this is done quickly, the spill should not reach underground aquifers or affect large amounts of surface water. The transportation of heavy crude oil is less hazardous to underground water supplies because the oil's viscosity inhibits it from soaking into the ground as quickly. Some of the most common causes of leaks are from pipe corrosion and accidental damage caused by excavating equipment.

Chevron (formerly Unocal) Pipeline System. Chevron pipelines run to the Santa Maria Refinery on the Nipomo Mesa the Sisquoc connection in Northern Santa Barbara County. From the refinery they run to the Avila Beach station, and continue through San Luis Obispo into the San Joaquin Valley. In addition, a natural gas pipeline system transports gas from the county to a facility in Santa Maria where the finished product is sent into the gas distribution network.

Celeron — All American Pipeline. Celeron Corporation in Houston, Texas owns and operates the All American Pipeline (AAPL). The AAPL extends from Santa Barbara County to refining facilities in Texas. The line originates in Las Flores Canyon, Santa Barbara, runs north to Gaviota and on to Sisquoc in Santa Maria, where Unocal recently constructed a pipeline connecting to their Santa Maria refinery. The All American Pipeline continues north to San Luis Obispo and heads east to Kern County. It travels parallel to the county line, with 37 miles of the line located in San Luis Obispo County. There are no pump stations or storage tanks sited in San Luis Obispo County associated with the pipeline.

Storage Facilities

A tank farm is a grouping of above ground storage tanks strategically placed for temporarily storing crude oil and refined or partially refined petroleum products. In the above facility descriptions tank farms are discussed as a part of a marine terminal or pump stations. Several other tank farms in the county are associated with oil fields or pipelines.

The San Luis Obispo tank farm is located adjacent to the City of San Luis Obispo and includes a pump station and abandoned facilities. The site is in remediation due to a large spill that occurred in 1927.

Natural Gas

The Southern California Gas Company's natural gas pipeline system serves most of the communities in the county. A significant portion of the rural population depends on propane service from San Luis Butane, Suburban Propane, Petrolane, Northern Energy, and Central Coast Propane. Pacific Gas and Electric brings gas through a 20-inch pipeline from Kettleman to run the Morro Power plant.

Southern California Gas Company. The Southern California Gas Company provides natural gas service to San Luis Obispo County. Transmission lines enter the county from the south and continue north, providing gas to the communities of Nipomo, Oceano, Arroyo Grande, Grover Beach, Pismo Beach, Shell Beach, and Avila Beach. The transmission lines branch off in Arroyo Grande; one line goes to the coast towards Pismo Beach and another line moves north to the City of San Luis Obispo. Near the airport the line branches off again this time west to Los Osos and Morro Bay. From this line a branch runs to Camp San Luis and Cuesta College.

A main transmission line moves along Highway 1, through Morro Bay, Cayucos, and ending in Cambria. At Toro Creek Road, a pipeline line heads east following Highway 41 up to Atascadero. Another line comes up from the San Luis Obispo following Highway 101. That line serves Santa Margarita, Garden Farms, and south Atascadero. It then continues north to Paso Robles, bringing gas to Templeton along the way. A line then runs west and connects with a Mobil gas line which serves the San Ardo oil field in Monterey County. A line runs northeast from Atascadero to parts of Creston and Shandon.

Pacific Gas and Electric. A 20-inch pipeline runs from the northeast portion of the county to the Morro Bay Power Plant. Along the way it serves some residents in Shandon. This pipeline originally provided gas to the former Unocal pump station at Shandon, but Chevron now uses its own pipeline to supply gas.

Gasoline and Diesel

The county gasoline and diesel supply is shipped in by either tanker or truck. (The only refinery in the county, Santa Maria Refinery, does not produce gasoline or diesel.) The gasoline and diesel sold in the county is distributed by truck shipments from refineries in Kern and Los Angeles Counties. Tanker shipments delivered to Unocal's Avila Beach tank farm occurred until 1995 when they were discontinued due to industry economics.